MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

EEE1026 – ELECTRONICS II

(All Sections / Groups)

12 MARCH 2018
02:30 p.m. - 04:30 p.m.
(2 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of **8** pages including cover page and **List of Equations** with **4** Questions only.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the answer Booklet provided.

QUESTION 1

(a) The Junction field effect transistor is important component in electronics Era, which can be used to design an amplifier.

(i) Give three advantages and three disadvantages of the Field effect transistors

[6 marks]

(ii) List important points about the difference of JFET compared with BJT

[6 marks]

(b) Refer to the circuit shown in **Figure Q1(b)** for the following questions.

(i) Compute the voltage values of upper trigger point (UTP) and lower trigger point (LTP). Given that the circuit output voltage has 1V loss and the threshold voltage of the diodes during forward bias is 0.7V.

[8 marks]

(ii) Sketch the output voltage, V_{out} waveform with respect to its input voltage, V_{in} waveform for the circuit shown in Figure Q1(b). The input voltage, V_{in} is a sinusoidal signal with peak-to-peak voltage, V_{pp} = 28V.

[5 marks]

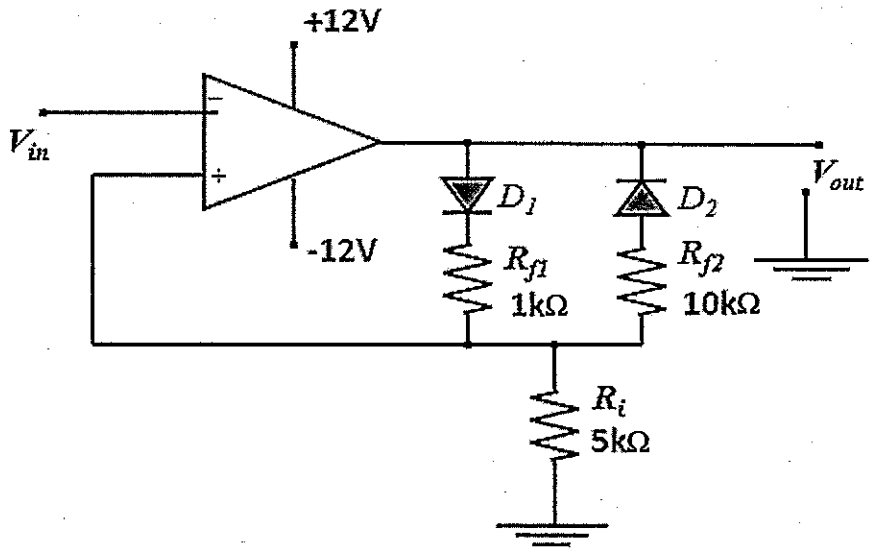

Figure Q1(b)

Continued ...

QUESTION 2

(a) A two-port active device with a feedback impedance, Z, and a voltage gain A_v, is represented by **Figure Q2(a)(i)**. If Z_A is the Miller Effect of the device at the input, and Z_B is the Miller Effect at the output, for the circuit in **Figure Q2(a)(ii)** is to be the equivalent circuit of the active device, prove that:

$$Z_A = \frac{1}{(1-A_V)}Z \quad \text{and} \quad Z_B = \frac{A_V}{(A_V-1)}Z$$ [6 marks]

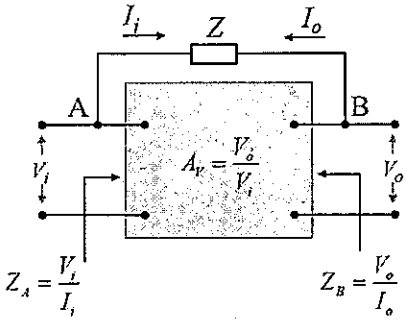

Figure Q2(a)(i)

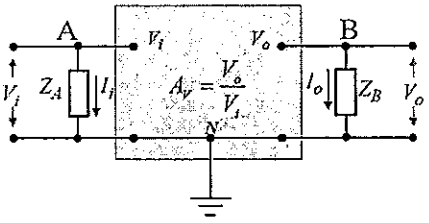

Figure Q2(a)(ii)

(b) A common-source JFET amplifier circuit is shown in **Figure Q2(b)**. The amplifier has the following parasitic and wiring capacitances that effect its performance at high frequencies:

C_{gs} = 2.5pF, C_{gd} = 2.0pF, C_{ds} = 2.5pF, C_{wi} = 1.0pF and C_{wo} = 1.0pF

(i) Draw the high-frequency small-signal equivalent circuit of the amplifier. [3 marks]

(ii) Compute the values of the total input resistance R_{Ti}, total input capacitance C_{ti}, total output resistance R_{To} and total output capacitance C_{To}. [4 marks]

(iii) Compute the values of the upper cutoff frequencies at the input and output circuits, f_{Hi} and f_{Ho}, and determine the effective high cutoff frequency [3marks]

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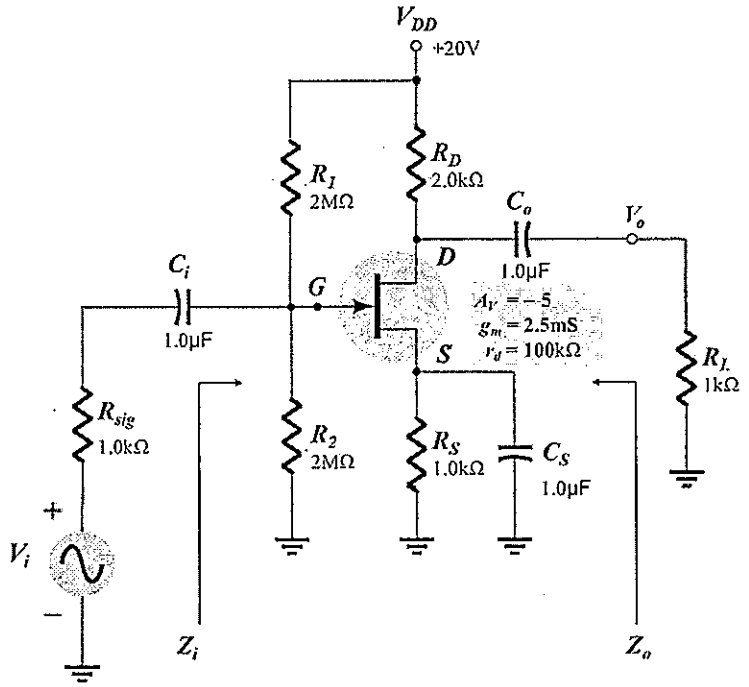

Figure Q2 (b)

(c) Draw the low-frequency small-signal equivalent circuit of the amplifier shown in **Figure Q2(b)**. [3 marks]

(i) Calculate the cutoff frequencies determined by the coupling capacitor C_i at the input and the coupling capacitor C_o at the output. [3 marks]

(ii) Determine the cutoff frequency determined by the by-pass capacitor Cs and the effective low frequency cut off. [3 marks]

Continued ...

QUESTION 3

(a) Power amplifiers have specific characteristics for each class. Briefly state their characteristics by filling in the table below.
(Redraw this table in your answer script)

Class	A	B	AB	C
Operation Cycle	i)	ii)	iii)	iv)
Power Efficiency	v)	vi)	vii)	viii)
Position of the Q-point for maximum efficiency	ix)	x)	xi)	xii)

[6marks]

(b) Calculate the following for the class A power amplifier shown in Figure Q3(b). Assume that the amplification factor β of the BJT is arbitrarily large.

(i) DC load line points

i) $I_{C(sat)}, V_{CE(off)}$ [2 +1 marks]

ii) I_{CQ} and V_{CEQ} [4 +3 marks]

(ii) AC load line points $i_{c(sat)}$ and $V_{ce(off)}$

[4+2 marks]

(iii) Efficiency of the amplifier given that the load power P_L is 0.64mv .

[3 marks]

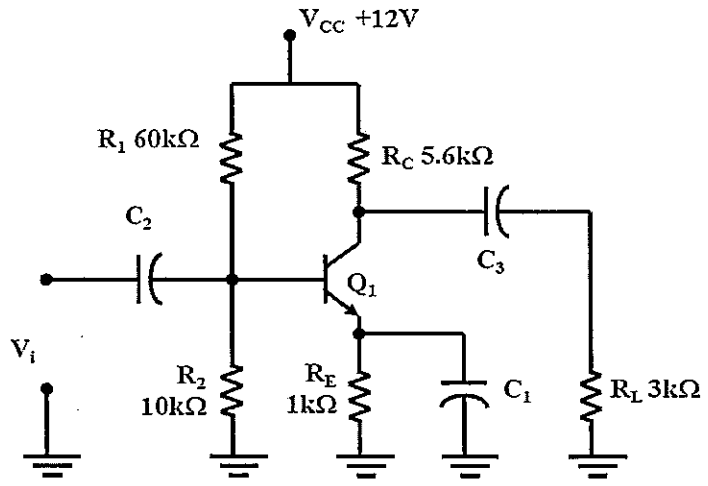

Figure Q3(b)

Continued ...

QUESTION 4

(a) The voltage divider biasing circuit is shown in **Figure Q4 (a)**. Given: V_{DD} =12V, R_1=6.8MΩ, R_2=1.0MΩ, R_D=3.3kΩ, R_S=2.2kΩ and this particular JFET has internal parameter such as $V_D \approx 7V$. Determine the following:

(i) Drain current (I_D)

[2.5marks]

(ii) Source Voltage (V_S)

[2.5 marks]

(iii) Gate Voltage (V_G)

[3 marks]

(iv) Gate-Source Voltage (V_{GS})

[2 marks]

(v) Drain-Source Voltage (V_{DS})

[3 marks]

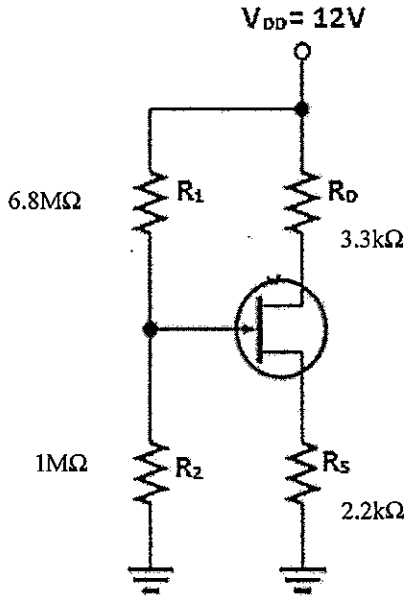

Figure Q4(a)

Continued ...

(b) Refer to the circuit shown in **Figure Q4(b)**, compute the value of the following parameters.

(i) Pulse width, T1.

[3 marks]

(ii) Space width, T2.

[3 marks]

(iii) Free running frequency, f_o.

[3 marks]

(iv) Duty cycle, D.

[3 marks]

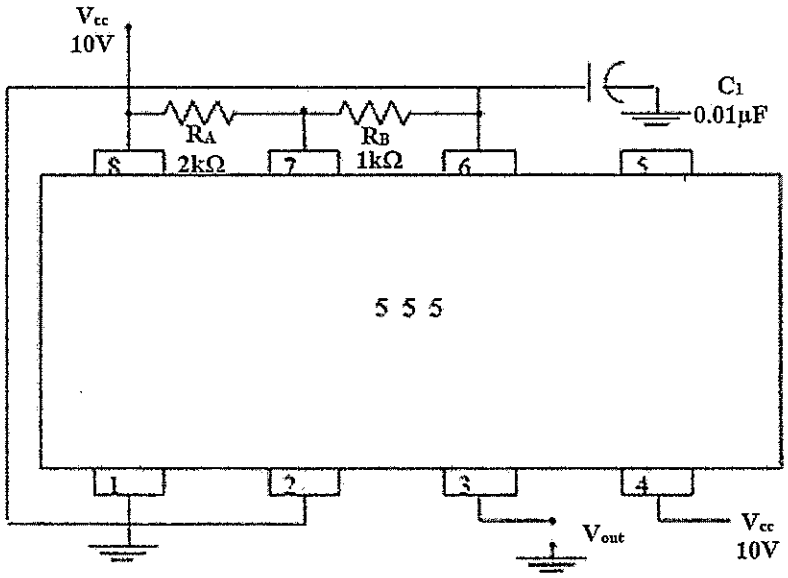

Figure Q4(b)

End of Questions

Appendix

List of Equations

$$I_D = I_{DSS}\left(1-\frac{V_{GS}}{V_{GS(OFF)}}\right)^2$$

$$\text{UTP} = \frac{-Ri}{Rf}V_{out-} \qquad \text{LTP} = \frac{-Ri}{Rf}V_{out+}$$

Miller's Effect at input: $C_A = C_{gd}(1\text{-}A_v)$
Miller's Effect at output: $C_B = C_{gd}(1 - 1/A_v)$

$$f_{Hi} = \frac{1}{2\pi R_{Ti}C_{ti}} \qquad f_{Ho} = \frac{1}{2\pi R_{To}C_{to}}$$

$$f_{Li} = \frac{1}{2\pi\left(R_{sig}+R_i\right)C_{ti}}$$

$$f_{L_E(bypass)} = \frac{1}{2\pi(R_{in(emitter)} \parallel R_E)C_E}$$

$$f_{L_S(bypass)} = \frac{1}{2\pi\left(R_S \parallel \frac{1}{g_m}\right)C_S}$$

$$\text{Tilt\%(P)} = \frac{V-V'}{V}, \quad f_L = \frac{P}{\pi}f_s$$

$$V_{CC} = I_C R_C + V_{CE} + I_E R_E$$

$$V_B = \frac{R_2}{R_1+R_2}V_{CC}$$

$PW = 0.693\ (R_A + R_B)\ C_1$, $SW = 0.693\ R_B C_1$

$$f = \frac{1.44}{(R_A+2R_B)C_1}$$

End of Paper